LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, May 6-10, 2013.

BloombergBusinessweek News From Bloomberg — FUSION IN BLOOM

Scientists aim laser beams at fuel encased in a canister inside the NIF's target chamber. Credit: Jake Stangel/Bloomberg Markets

Fifty miles east of San Francisco, 1,200 scientists and staff are on a quest to create fusion energy at Lawrence Livermore's National Ignition Facility.

During a shot, the scientists stare at 5-foot-high (1.5-meter-high) screen projections as the world's most powerful supercomputer sorts data. Panels turn green to show the laser is storing energy as it looms in the 10-story building above. In the blink of an eye, the laser unleashes its juice.

The laser can deliver 1,000 times more energy than the U.S. electrical grid at any given time. Ed Moses, the principal associate director for the NIF and Photon Science Directorate, wants to harness that energy for practical uses.

To read more go to *Bloomberg Businessweek*.

nature — DYNAMO-MITE

East limb view of the Earth's moon as seen by Clementine. Image courtesy of NASA.

New evidence from ancient lunar rocks suggests that the moon's long-lived dynamo -- a molten, convecting core of liquid metal that generated a strong magnetic field -- lasted 160 million years longer than originally estimated and was continuously active until well after the final large impacts.

Lawrence Livermore scientist William Cassata and a group of international collaborators analyzed two rocks gathered during the Apollo 11 mission and found that they were magnetized in a stable and surprisingly intense magnetic field. The study of these slowly cooled, unshocked rocks demonstrates that the moon had a core dynamo as late as 3.55 billion years ago.

"The important implication of this discovery is that the moon possessed a magnetic field much later than would be expected for a body of its size," Cassata said.

To read more, go to *Nature*.

YAHOO! STAR TREK BOLDLY GOES TO LLNL

One of the ways director J.J. Abrams' reboot of "Star Trek" in 2009 differentiated itself from the previous TV and movie incarnations was its massive scale. Everything in the movie was bigger than seen before: the action, the special effects, and even the interior of the Enterprise itself.

For this summer's sequel, "Star Trek Into Darkness," which opens May 17, the filmmakers went to a new location that was quite a bit more high-tech and in line with the scientific ideals of "Star Trek": the National Ignition Facility (NIF), the world's largest laser, at the Lawrence Livermore National Laboratory.

The NIF has a system of 192 laser beams that are able to generate temperatures of more than 100 million degrees to study photon science and the nature of anti-matter.

"We were there just trying to shoot a movie, but all around us, these innovative scientists are working on technologies that will likely help the whole world," Abrams said.

Abrams said he was intrigued not just by the work being done at NIF to develop renewable, clean energy sources, but at the influence "Trek" had on people's lives. He said, "So many people told us Star Trek inspired them to get involved in science."

To read more, go to Yahoo.

physicstoday GOTTA WASH THAT CO2 RIGHT OUT OF THE AIR

CO2 capture always will add to the cost of making electricity. That means it won't be commercially viable until a price is imposed on CO2 emissions.

Roger Aines, principal investigator on a Lawrence Livermore CO2 capture project funded by the Department of Energy's Advanced Research Projects Agency–Energy's (ARPA–E), says he's not expecting development to be fast.

"It's time to develop the basics and get things right," he said, noting that capture technology was even less far along when the Obama administration pushed for a cap-and-trade system in 2009.

Aines's process uses microcapsules composed of an elastomer that is permeable to CO2. Inside the 400- to 500-micron-diameter capsule are a liquid carbonate and a synthetic catalyst acting in the same way as the human carbonic anhydrase enzyme that helps separate CO2 from blood and tissue in the breathing process.

The catalyst speeds the carbonate's capture of CO2. Heating the capsules in the presence of nitrogen drives off the CO2, which can then be compressed for storage.

To read more, go to *Physics Today*.

HPC wire AT WARP SPEED

Lawrence Livermore scientists, from left, David Jefferson and Peter Barnes.

Computer scientists at Lawrence Livermore and Rensselaer Polytechnic Institute have set a high performance computing speed record that opens the door to the scientific exploration of complex planetary-scale systems.

In a paper to be published this month, the joint team will announce a record-breaking simulation speed of 504 billion events per second on LLNL's Sequoia Blue Gene/Q supercomputer, dwarfing the previous record set in 2009 of 12.2 billion events per second.

Constructed by IBM, the 120-rack Sequoia supercomputer has a peak performance of 25 petaflops and is the second fastest supercomputer in the world, with a total speed and capacity equivalent to about one million desktop PCs. A petaflop is a quadrillion floating point operations per second.

In addition to breaking the record for computing speed, the research team set a record for the most highly parallel "discrete event simulation," with 7.86 million simultaneous tasks using 1.97 million cores. Discrete event simulations are used to model irregular systems with behavior that cannot be described by equations, such as communication networks, traffic flows, economic and ecological models, military combat scenarios and many other complex systems.

To read more, go to *HPC Wire*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail.